Screening and Ranking Framework for Geologic CO_2 Storage

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RESEARCH OBJECTIVES

The injection of CO_2 into deep geologic formations for geologic CO_2 storage involves the risk that CO_2 will leak from the target formation to the near-surface environment. Once in the near-surface environment, CO_2 can cause detrimental health, safety, and environmental (HSE) effects. One consideration in the selection of geologic CO_2 storage sites is the minimization of potential HSE risks. The objective of this work is to develop a screening and ranking framework (SRF) to evaluate the relative risk that CO_2 will leak to the near-surface environment and cause HSE effects. The SRF is designed so that it can be applied to sites with limited data as appropriate for pilot studies. The expected users of the SRF are geoscientists or hydrologists with access to limited published information about the site in reference books or maps. In short, the framework is designed to answer the question, "From a choice of several potential sites, which site has the lowest HSE risk?"

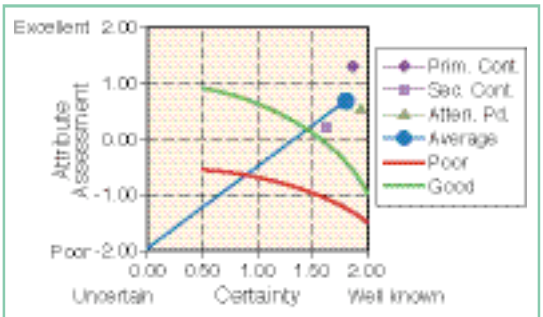

Figure 1. Summary graphic showing the attribute assessment (y-axis) and uncertainty (x-axis) of the three fundamental characteristics along with qualitative regions of "poor," "fair," and "good" HSE risk for the Rio Vista gas field

APPROACH

The approach stems from the realization that HSE risk is related to three fundamental characteristics of a geologic carbon storage site:

1. Potential of the target formation for long-term containment of CO_2
2. Potential for secondary containment, should the primary target site leak
3. Potential of the site to attenuate and/or disperse leaking CO_2, should the primary formation leak and secondary containment fail

The SRF tool is designed to provide a qualitative and independent assessment of each of these three characteristics, through a numerical evaluation of properties/values associated with various attributes of the three general characteristics. For example, three attributes of the potential for the target formation to contain CO_2 for long periods are (1) the nature of the primary seal, (2) the depth of the reservoir, and (3) the properties of the reservoir. The properties of the primary seal attribute are thickness, lithology, demonstrated sealing capacity, and lateral continuity. Similar properties for all of the other attributes are listed in the spreadsheet. The user simply assigns numerical values to these attributes, based on suggestions in the spreadsheet. In addition, the user must assign weights and uncertainties to the properties, which are carried along to the final display. The results are summarized and displayed graphically in the summary worksheet, one graphic from which is shown in Figure 1.

ACCOMPLISHMENTS

An HSE screening and ranking framework has been developed, based on the three fundamental characteristics of a CO_2 sequestration site. The system allows the user to arbitrarily weight and assign uncertainty to the properties associated with the attributes of the fundamental characteristics, to evaluate and rank two or more sites relative to each other. We emphasize that the SRF tool is intended to guide the selection of the most promising sites, for which more detailed risk assessment would be carried out. Testing and further development of the SR framework are under way.

SIGNIFICANCE OF FINDINGS

The SRF shows that comparative evaluations of prospective sites with limited characterization data can be accomplished, and that the ranking offers a way of screening sites based on potential for CO_2 leakage and seepage, as well as related HSE risk.

RELATED PUBLICATION

Oldenburg, C.M., HSE screening risk assessment (SRA) for geologic CO_2 sequestration. Fourth Annual Conference on Carbon Capture and Sequestration, Alexandria, Virginia, May 2–5, 2005. Berkeley Lab Report LBNL-57280.

ACKNOWLEDGMENTS

This work was supported in part by WESTCARB through the Assistant Secretary for Fossil Energy, Office of Coal and Power Systems, through the National Energy Technologies Laboratory (NETL), and Lawrence Berkeley National Laboratory, under Department of Energy Contract No. DE-AC03-76SF00098.